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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 10/776,063      | 02/11/2004  | John S. Benco        | 1657/2052           | 2112             |

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PALMER & DODGE, LLP  
PAULA CAMPBELL EVANS  
111 HUNTINGTON AVENUE  
BOSTON, MA 02199

EXAMINER

SODERQUIST, ARLEN

|          |              |
|----------|--------------|
| ART UNIT | PAPER NUMBER |
|----------|--------------|

1743

DATE MAILED: 08/18/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

|                              |                               |                              |  |
|------------------------------|-------------------------------|------------------------------|--|
| <b>Office Action Summary</b> | Application No.<br>10/776,063 | Applicant(s)<br>BENCO ET AL. |  |
|                              | Examiner<br>Arlen Soderquist  | Art Unit<br>1743             |  |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-53 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-53 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on 11 February 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. ____. |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)  | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>7-9-04</u> . | 6) <input type="checkbox"/> Other: ____.  |

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1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

2. Claims 1-53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Benco (*Journal of Photochemistry and Photobiology A*, 2002) in view of Pacey (US 4,659,815) and Barnard (US 6,417,005 or WO 97/39337). In the paper Benco teaches 9-anthryl-substituted azacrown ether covalently linked to a 1,3-alternate calix[4]arene as a fluoroionophore for the detection of potassium ions. *N*-(9-methyl-anthracene)-25,27-bis(1-propyloxy)calix[4]arene azacrown-5 (**II**) and its model compound *N*-(9-anthrylmethyl)aza-18-crown-6 (**I**) were synthesized and tested as fluoroionophores for the selective detection of potassium ions with a view to the use of **II** in the fabrication of potassium ion sensors. Compound **II** consists of a 1,3-alternate calix[4]arene group covalently linked to an azacrown ether that is *N*-substituted with a fluorescent anthracene group. This compound acts as an 'off-on' fluorescent indicator for ion complexation. In dichloromethane solution, compound **II** exhibits good sensitivity to potassium ions and forms a 1:1 fluoroionophore-ion complex. Studies demonstrate that **II** is selective for potassium over other alkali metal cations, with excellent selectivity over sodium and lithium ( $\log K_{K,Na} \sim \log K_{K,Li} \leq -3.5$ ) and moderate selectivity over rubidium and cesium ( $\log K_{K,Rb} \sim \log K_{K,Cs} \sim -1$ ). Sensitivity of **II** to potassium is considerably enhanced in dichloromethane in comparison to methanol/dichloromethane mixtures, presumably due to two effects: a hydrogen-bonding interaction of methanol with the azacrown nitrogen atom, and poor solvation of the ion by dichloromethane, the latter creating a driving force for complexation. On page 37 there is a

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discussion of selectivity. The first sentence of this section teaches that the eventual intention is to use molecules similar to II as a sensor. The next sentence teaches that given the structural similarities between II and 1,3 alternate calix[4]arenes, it is reasonable to expect similar binding properties. The next sentence teaches that they expect metal complexation in II to be governed by electrostatic interactions (primarily cation- $\pi$  interactions). That sentence also teaches that the selectivity is primarily controlled by a size fit effect and steric effects from the propyl substituents appended to the two rotated aryl rings of the calix[4]arene. Benco does not teach an azacrown calix[4]arene sized to capture lithium or structures related to sensor formation.

In the patent Pacey teaches chromogenic aza-12-crown-4 ethers used for the spectrophotometric determination of lithium ion in aqueous solutions. The compounds are particularly useful for the analysis of lithium in the presence of  $\text{Na}^+$ , a situation common in biological and geological systems. The compounds [e.g., 1-(2-oxy-5-nitrobenzyl)-1-hydro-1-aza-4,7,10-trioxacyclododecane] are similar in structure to compound I of Benco except they have a smaller crown and a colorimetric group appended to the crown. Column 1, lines 30-43 teach that selective reagents permitting the isolation of a particular ion from a complex matrix or mixture of ions are of interest to those in the chemical or bio-chemical analytical fields. When the matrix in question includes two or more cations of the Group I metals, it is often difficult to selectively isolate one of the Group I cations from the mixture without interference from other cations in the system. With respect to biological systems, such as blood serum, which contains a relatively large amount of sodium ion, a reagent having the ability to selectively (and quantitatively) extract lithium ion in the presence of sodium ion is of interest for bio-chemical assays. Some examples of prior art molecules are taught with drawbacks being explained. Column 3, lines 11-19 and example 9 teach the selectivity of the molecules of the invention when lithium is complexed in the presence of a large excess of sodium. Example 7 shows the ability of the reagents to complex lithium in the presence of a potassium hydroxide buffer and example 11 shows the ability to measure lithium in blood and urine samples. These results shown in table 2 show excellent correlation with the known amount of lithium present.

In the patent and published application Barnard teaches covalently immobilized fluoroionophores as optical metal ion sensors. Since both are members of the same patent family

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only the US patent will be described but corresponding disclosure also exists in the published application. Fluoroionophores that are fictionalized with reactive groups may be covalently bound to inorganic or organic carrier materials and are used as active components in polymer membranes of optical sensors for the detection of ions. The sensors are distinguished by a long usable life and a high degree of sensitivity. In the formula taught, and ionophore, I, can have a number of forms and are natural or synthetic organic compounds that contain a plurality of mostly alternating electron-rich hetero atoms such as, for example, S, N and especially O, in an open-chained or cyclic carbon chain and that enable the ions to be measured to be selectively complexed. Column 2, line 60 to column 3, line 7 teach these ionophores derived from substances that have an oligoether, polyether, oligoester, polyester, oligoamide or polyamide structure. Examples of such suitable substances may be crown ethers, coronandenes, cryptandenes, **calixarenes**, podandene or derivatives thereof, also cyclic peptides, for example valinomycin, nonactin, peptides such as gramicidin, and peptides which in the presence of the ion to be determined change their secondary, tertiary or quaternary structure for bonding the ion; it is also possible to use tetrahydrofuran-containing macrolides bonded via ester bridges, and analogous substances that are able to regulate transport in biological systems, or cyclic oligosaccharides, such as, for example, cyclodextrins or cyclophanes. Columns 5-8 show the structure of several of these with structure (IV) being a calix[4]arene. Columns 8-11 show various examples of the fluorophores used in the fluoroionophores. Columns 13-18 specifically show structures of three calix[4]arene fluoroionophores. Columns 20-22 teach a wide variety of carrier materials. Column 29 teaches that the compositions taught may be applied to suitable support materials. The support is preferably transparent and may be formed, for example, from a plastics material, such as, for example, polycarbonate or acrylic glass, mineral materials, metal oxides or glass, and may be of any shape, for example in the form of plates, cylinders, tubes, strips or fibers. The optical range in which the material as sensor can be excited extends from the ultraviolet range to the infrared range. The immobilized fluorophore-ionophores have very suitable absorption and emission wavelength ranges that allow the use of known economically priced low-energy light sources, for example halogen or xenon lamps or light-emitting diodes. Commercially obtainable optical fibers may be used in the excitation and detection. Column 30 teaches that one very important advantage is that the immobilized fluoroionophores can carry out

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the analyses being substantially independent of pH and therefore may be carried out directly in body fluids such as blood, urine and serum. Among the many cations that the compounds can be used for, the alkali metal ions including lithium are preferred cations (column 30).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the azacrown portion of the Benco fluoroionophore to correspond to that of the difference between the model azacrown of Benco and the similar azacrown of Pacey because of the recognition by Benco that the binding is related to the size fit effect and the teaching that lithium is an important analyte that can be complexed by the smaller azacrown of Pacey with a high selectivity with respect to the complexation of sodium in a biological sample. It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the fluoroionophore of Benco into a carrier material and or onto a support as taught by Barnard because of the advantages in carrying out the analysis as taught by Barnard.

3. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thornton*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

4. Claims 1-53 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-28 of U.S. Patent No. 6,660,526 in view of Benco, Pacey and Barnard as explained above. The patented claims are directed to a molecule, device and method that encompass the molecule, device and method taught by Benco above, therefore they differ from the instant claims as the Benco reference differs from the instant claims. Thus for the reasons given above, the instant claims are obvious in view of the patented claims.

5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The additionally cited art is directed toward molecules and methods for complexing

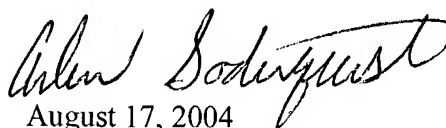
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metal ions with azacrown ethers and calixarenes. Of particular interest is the Dozol reference teaching a structure that encompasses the calixarene portion of the instantly claimed fluoroionophores.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Arlen Soderquist whose current telephone number is (571) 272-1265 as a result of the examiner moving to the new USPTO location. The examiner's schedule is variable between the hours of about 5:30 AM to about 5:00 PM on Monday through Thursday and alternate Fridays.

A general phone number for the organization to which this application is assigned is (571) 272-1700. The fax phone number to file official papers for this application or proceeding is (703) 872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



August 17, 2004

ARLEN SODERQUIST  
PRIMARY EXAMINER